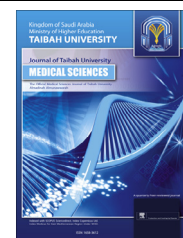




Taibah University

Journal of Taibah University Medical Sciences

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Clinical Study

Snodgrass urethroplasty for hypospadias repair: A retrospective comparison of two variations of the technique

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Received 14 April 2013; revised 3 October 2013; accepted 20 October 2013

المخلص

أهداف البحث: تعد طريقة "سنودجراس" لإصلاح المبال التحتي طريقة مقبولة على نطاق واسع. نستعرض في هذا البحث تجربتنا مع طريقة "سنودجراس" لإصلاح المبال التحتي بمقارنة طريقتين لعمل هذا الإصلاح فيما يتعلق بمضاعفات مابعد الجراحة والنتائج، مع التركيز بشكل خاص على تضيق الصماخ، وتكون الناسور، وانحناء القضيب المتبقي والتواء القضيب.

طرق البحث: أجريت هذه الدراسة بأثر رجعي بمراجعة نتائجنا لإصلاح المبال التحتي بطريقة "سنودجراس" التي أجريت في الفترة مابين مارس 2007 وفبراير 2012م في مستشفى الولادة والأطفال، بالمدينة المنورة، المملكة العربية السعودية. اعتماداً على طول شق الصفيحة الإحليلية، نوع السديلة المستخدمة ودرجة لحب جلد القضيب، وتم تقسيم المرضى إلى مجموعتين.

النتائج: أجرينا 320 حالة متوسط أعمارهم 1.5 عاماً. حدثت مضاعفات عند 45 مريضاً (14.06%). وظهر ناسور جلد في الإحليل عند ثمانية مرضى (2.5%)، منها ست حالات في المجموعة أ (5.22%) وحالتان في المجموعة ب (0.98%). كما ظهر عند عشرة مرضى (3.13%) تضيق في الصماخ، سبعة في المجموعة أ وثلاثة في المجموعة ب. وسجل التواء القضيب عند 13 مريضاً بعد العملية (4.06%)، تسع حالات في المجموعة أ (7.83%)، وأربع في المجموعة ب (1.95%). هناك فروق بين المجموعتين ذات دلالة احصائية فيما يتعلق بظهور الناسور، وتضيق الصماخ والتواء القضيب (قيمة $P = 0.027$, 0.028 , $P = 0.013$ على التوالي).

الاستنتاجات: تعد طريقة "سنودجراس" لإصلاح المبال التحتي طريقة ممتازة. يؤثر طول الشق بالصفحة الإحليلية، ونوع السديلة المستخدمة لتغطية الإحليل الجديد ودرجة لحب جلد القضيب على معدل حدوث المضاعفات.

الكلمات المفتاحية: راب الإحليل بطريقة سنودجراس؛ إصلاح المبال التحتي؛ تضيق الصماخ؛ تكون النواسير؛ انحناء القضيب المتبقي؛ المضاعفات الجراحية

Abstract

Objectives: The Snodgrass technique is a widely accepted method for hypospadias repair. In this paper, we compare two methods of performing this technique with respect to postoperative complications and outcome, with emphasis on meatal stenosis, fistula formation, residual chordee and penile torsion.

Methods: We reviewed the results of 320 cases treated by Snodgrass urethroplasty between March 2007 and February 2012 at the maternity and children's hospital of Almadinah Almunawwarah, Kingdom of Saudi Arabia. The two methods differed in the extent of urethral plate incision, the type of flap used and the degree of degloving of the

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penile skin. In group A (115 boys), the urethral incisions and the sagittal deep longitudinal incision were extended from the posterior edge of the hypospadiac meatus to the tip of glans, and the neourethra was covered by a dorsal preputial flap. In group B (205 boys), the urethral incisions and the deep longitudinal incision extended to the mid-glans, and the neourethra was covered by a lateral dartos flap. After tubularization of the urethral plate and a circumferential incision proximal to the coronal sulcus from each edge of the urethral plate, the penile skin was degloved from 1 cm proximal to the hypospadiac meatus in group A and to the penoscrotal junction in group B.

Results: The mean age of the children was 1.5 years. Complications occurred in 45 patients (14.1%). A urethrocutaneous fistula occurred in 8 patients (2.5%), with 6 in group A (5.2%) and 2 in group B (0.98%). Ten patients (3.1%) developed meatal stenosis, with 7 in group A and 3 in group B. Penile torsion was recorded postoperatively in 13 patients (total rate, 4.1%), with 9 cases in group A (7.8%) and 4 in group B (2.0%). The differences between the two groups were statistically significant.

Conclusion: A shorter urethral plate incision, use of a lateral dartos flap to cover the neourethra and more extensive skin degloving in Snodgrass urethroplasty reduce the rate of complications.

Keywords: Almadinah; Hypospadias; Snodgrass; Urethroplasty

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Introduction

Hypospadias is one of the commonest congenital anomalies of the male genital system. The reported incidence in the USA in 2001 was 1 per 200–300 live male births,¹ while the rate in the Netherlands in 2002 was 3 per 1000 live male births.² In addition to the abnormal position of the urethral meatus on the ventral penile surface, it may also be associated with ventral curvature of the penis (chordee). Hypospadias causes not only functional problems but also psychological problems for patients and their parents. Many techniques have been described for repairing hypospadias, but none was considered the standard method. In 1994, Snodgrass described tubularized incised plate (TIP) urethroplasty for distal penile hypospadias repair. It was subsequently also applied to proximal hypospadias, with encouraging results.^{3,4} The longitudinal split of the urethral plate described by Snodgrass represents significant progress in urethral plate-preserving surgery, permitting tension-free tubularization of the urethral plate to form a neourethra of adequate size. The technique is now widely accepted.⁵ The principal steps are a deep longitudinal incision of the urethral plate to allow tubularization, and addition of a layer between the neourethra and the overlying skin to avoid urethrocutaneous fistula.^{6,7}

The surgical goals of hypospadias repair are full straightening of the penis, formation of a hairless urethra of uniform caliber and adequate size, positioning of the meatus at the tip of

the glans and normal penile appearance with minimum complications. Nevertheless, complications such as fistula, meatal stenosis, urethral flap necrosis and dehiscence are still encountered.

Surgeons use small variations in the technique to limit the complications. The distal limit of the deep longitudinal incision may be either the mid-glans or the tip of the glans. The covering flap of the neourethra is usually raised from the preputial skin; however, this may result in penile torsion and devascularization of the preputial skin that is often used in reconstruction of the penile skin.⁸ A ventral dartos flap has been used to cover the neourethra in order to avoid these complications. Despite such modifications, complications of hypospadias repair, such as fistulae, urethral stricture, meatal stenosis, penile torsion, persistent chordee, infections and wound dehiscence, are still reported.⁹ In this paper, we describe our experience with two variations in performing Snodgrass TIP urethroplasty with respect to postoperative complications and outcomes, with emphasis on meatal stenosis, fistulae formation, residual chordee and penile torsion.

Materials and Methods

We reviewed the results of Snodgrass TIP urethroplasty in hypospadias repair performed between March 2007 and February 2012 at the pediatric surgery department of the maternity and children's hospital in Almadinah Almunawwarah, Kingdom of Saudi Arabia. Cases of proximal hypospadias, hypospadias with severe chordee and those who had undergone previous urethroplasty were excluded. Distal hypospadias in 320 boys aged 8 months to 12 years were included, with data on the demography of the patients, type of hypospadias, extent of urethral plate incision, type of flap used to cover the urethroplasty, the surgical outcome and follow-up for meatal stenosis.

All operations were performed with the patient in the supine position under general anesthesia with supplementary caudal analgesia (0.25% bupivacaine at 1 ml/kg body weight). A stay suture was placed on the dorsal side of the glans for handling, and the urethral plate was outlined at a width of 6–8 mm. We divided the patients into two groups on the basis of the limit of urethral plate incision, type of supporting flap used and the degree of degloving of the penile skin.

In group A (115 cases), the urethral plate defining incisions and the sagittal deep longitudinal incision were extended from the posterior edge of the hypospadiac meatus to the tip of glans, and the neourethra was covered by a dorsal preputial flap. In group B (205 cases), the urethral incisions and the deep longitudinal incision were extended to the mid-glans, and the neourethra was covered by a lateral dartos flap (Figures 1–4). In both groups, the urethral plate was tubularized over a 8–10 Fr fenestrated silicone catheter (depending on the child's age) with a continuous 6-0 PDS absorbable suture to create the neourethra, and the catheter was left for 3–4 days postoperatively. A circumferential incision 5 mm to 1 cm proximal to the coronal sulcus was extended from each edge of the urethral plate. Then, the penile skin was degloved to various degrees, from 1 cm proximal to the hypospadiac meatus in group A or down to the penoscrotal junction in group B.

The glandular wings were approximated by a 6-0 vicryl absorbable suture, and the distal ends were fixed to the



Figure 1: Outline of the extent of U-shaped incision and midline urethral plate incision in group A patients (to tip of glans).



Figure 2: Outline of the extent of U-shaped incision and midline urethral plate incision in group B patients (to mid-glans level).

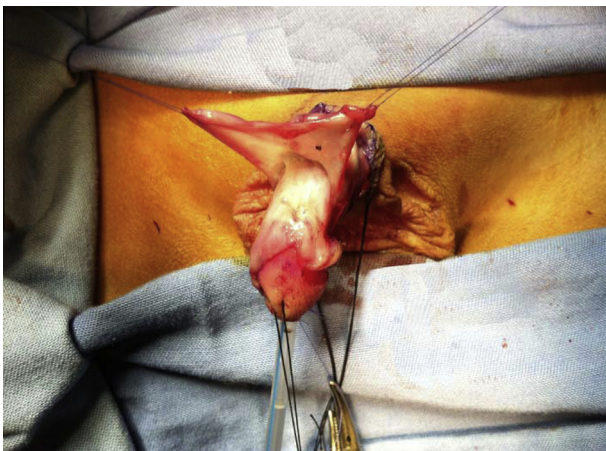


Figure 3: Raised preputial flap in group A patients.

underlying neourethra at 5 and 7 o'clock with the same type of suture. After the completion of repair, a urethral stent was fixed to the glans penis with a 3/0 silk suture. All patients were

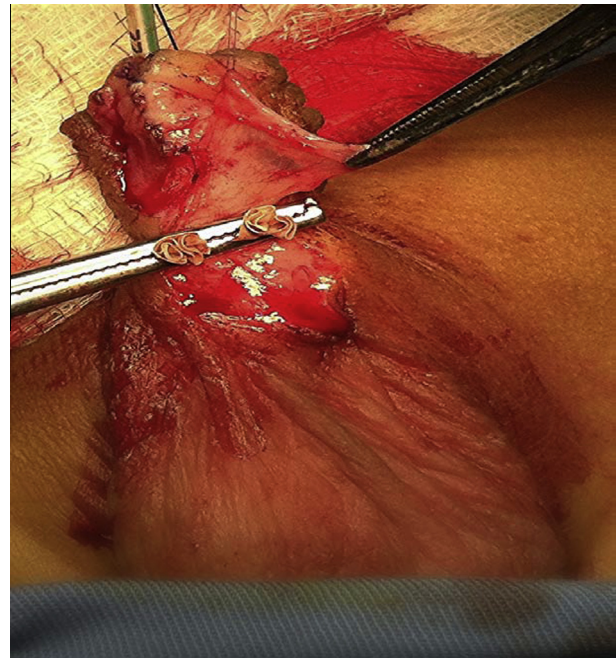


Figure 4: Raised ventral dartos flap in group B patients.

admitted to the hospital postoperatively and usually discharged after the catheter was removed between the 3rd and 4th day postoperatively. A slit, vertically oriented, oval meatus and a conical glanular shape with a direct urinary stream were the criteria for good results.

Data were collected and entered into the computer with the SPSS program. Qualitative data were expressed as frequencies and percentages and compared by the Fisher's exact test. *P* values were considered significant at ≤ 0.05 .

Results

The mean age of the 320 cases was 1.5 years (range 8 months to 12 years). The positions of the urethral meatus in the sample and in each group are shown in [Table 1](#). An adequately functioning neourethra with a slit-like meatus at the tip of the glans was achieved in 288 (95%) patients. The length of the neourethra created after chordee release was 1.3–5.4 cm (mean, 3.1 cm).

Complications occurred in 45 patients, at a rate of 14.1% ([Table 2](#)). A urethrocutaneous fistula occurred in 8 patients (2.5%), with 6 in group A (5.2%) and 2 in group B (0.98%). The location of the fistulae was sub-coronal in two patients and distal penile in seven; reoperation with two layers was required in 6 cases 6 months postoperatively, with good outcomes, and the other 2 cases healed after conservative

Table 1: Types of hypospadias and number of cases studied.

Type of hypospadias	Total (320 patients)	Group A (115 patients)	Group B (205 patients)
Glanular	33	18	15
Coronal	90	30	60
Distal penile	150	50	100
Mid-penile	47	17	30

Table 2: Complication rates among 320 patients operated for hypospadias by two technical variations.

Type of complication	Total No. (%)	Group A (115 cases) No. (%)	Group B (205 cases) No. (%)	P
Urethrocutaneous fistula	8 (2.5)	6 (5.2)	2 (0.98)	0.027
Meatal stenosis	10 (3.1)	7 (6.1)	3 (1.5)	0.028
Postoperative penile rotation	13 (4.1)	9 (7.8)	4 (2.0)	0.013
Wound infection	5 (1.6)	2 (1.7)	3 (1.5)	0.059
Catheter blockage	9 (2.8)	4 (3.5)	5 (2.4)	0.41
Total	45 (14.1)	28 (24.4)	17 (8.3)	–

management of meatal stenosis with dilatation. Ten patients (3.1%) developed meatal stenosis and had a thin, weak urinary stream 1 month after urethroplasty; nine cases responded to regular dilatation for 3 months, while one patient required meatoplasty. Penile torsion was recorded postoperatively in 13 patients (total rate, 4.1%), with 9 cases in group A (7.8%) and 4 in group B (2.0%). Eight cases were mild and required no intervention, while the other five cases required mild degloving and adjustment of penile direction, performed 8 months to 1 year postoperatively.

The differences between the two groups in the occurrence of urethrocutaneous fistula, meatal stenosis and postoperative penile torsion were statistically significant ($P = 0.027, 0.028$ and 0.013 , respectively). There was no significant difference between the two groups in the occurrence of wound infection or catheter blockage rate.

Discussion

In this comparison of two variations of the Snodgrass TIP technique, patients in group A received the first neourethral tube stitch near the tip of the glans, distal to the middle glanular level. This technique was associated with a higher incidence of meatal stenosis (6.1%) in comparison with group B, in which no more than one stitch beyond the middle glanular level was made during urethroplasty, with a lower rate of meatal stenosis (1.5%). This finding is in agreement with those of Al-Hunayan et al.⁷ and Mehmet et al.¹⁰ who reported marked decreases in the rate of meatal stenosis with the second method (from 24% to 15% and from 18% to 5%, respectively).

Another variation we used was to secure the neurethra to the glans to decrease the risk for retraction of the urethra and hence the development of meatal stenosis. Although this was not described by Snodgrass et al. in their initial report,³ in reviews^{9,11} they mentioned that the meatus should be stitched to the glans at 5 and 7 o'clock to improve the cosmetic result as well as to decrease the occurrence of meatal stenosis. Mehmet et al.¹⁰ proposed that the meatus secured to the glans

at three points (4, 6 and 8 o'clock). Meatal stenosis in our patients was managed by regular dilatation, with meatoplasty required in only one case. Another important step in the Snodgrass repair is the interposition of a barrier layer (flap) between the neourethra and the overlying skin in order to decrease the rate of urethrocutaneous fistula formation. The most popular flap used is the preputial flap; however, mobilization and ventral transposition of the flap around one side of the penile shaft may cause penile torsion, especially if the flap is of inadequate length and laid on with tension. Moreover, dissection of the flap may jeopardize the blood supply to the dorsal skin, which is often used for resurfacing closure, and may thus predispose to skin loss and failure of the repair.

To avoid penile torsion, a modification of the way in which the preputial flap is immobilized has been described.¹² A window is created in the flap at the midline, and the penile shaft is pulled through it in order to transfer the dartos flap ventrally over the neourethra. The size of the flap may, however, be inadequate to cover the repair when the ventral skin is deficient, and another modification in flap creation was described, which is to raise the ventral dartos flap to cover the neourethra. This technique was claimed to be associated with a low fistula rate and easier harvesting and mobilization of the flap to cover the neourethra.^{7,13} We tested both types of flap, the preputial flap in group A and the lateral dartos flap in group B, and found statistically significantly higher rates of fistula formation (5.2%) and penile torsion (7.8%) in group A than in group B (1.46% and 1.9%, respectively). We found that the lateral dartos flap is usually easily raised and mobilized to the midline. It is also a good option in cases in which the child has been circumcised before urethroplasty, as there is no preputial flap. Other modifications of the tissue covering TIP urethroplasty and the rates of fistula formation published in the literature are summarized in Table 3.

Another factor that may affect penile alignment is the degree of penile skin degloving during hypospadias repair: complete degloving to the penoscrotal junction or limited to the area around the urethral meatus. Turialis et al.²⁰ recommended limited degloving of the penile skin in order to

Table 3: Types of supportive tissue covering TIP urethroplasty and rates of fistula formation.

Tissue covering TIP repair	Reference (No.)	Date	No. of patients	No. of fistulas (%)
Lateral dartos flap	Al-Hunayan et al. ⁷	2003	83	4 (5)
De-epithelialized preputial flap	Jayanthi ¹⁴	2003	110	1 (1)
De-epithelialized preputial flap	Baccala et al. ¹⁵	2005	101	2 (2)
Para-urethral dartos flap	Mustafa ¹⁶	2005	15	1 (7)
Double dartos flap	Bakan and Yildiz ¹⁷	2007	45	0
Combined Mathieu and Snodgrass	Elganainny et al. ¹⁸	2010	101	8 (7.9)
Modified preputial flap	El-Kassaby et al. ¹⁹	2012	764	16 (2)

limit the need for a large covering layer of the neourethra, whereas Selami and Warren²¹ performed complete degloving of the penile skin to provide full erection and prevent postoperative torsion or chordee. Another topic of controversy in TIP urethroplasty is the use of a urethral stent. Proponents of stenting argue that it keeps the dorsal midline incision stretched open and limits premature healing, which would obviate the benefit of the dorsal incision.¹⁴ In descriptions of cases with no stenting, however, no cases of urethrocutaneous fistula, urethral stricture or meatal stenosis have been reported.^{20,22} We stented all patients in both groups for 3–4 days, which allowed drainage of the urinary bladder and prevented voiding due to the surgery. It also helps hemostasis, reduces post-operative bleeding and in the same time this short period, avoids the problem of catheter blockage, bladder irritation and long hospital stays.

The retrospective nature of this study limits its generalization, and a prospective comparative study is recommended. In conclusion, a shorter urethral plate incision, use of a lateral dartos flap to cover the neourethra and more extensive skin degloving in Snodgrass urethroplasty reduce the rate of complications. The use of a stenting catheter should not exceed 3 days post-operatively in order to avoid its complications.

Conflict of interest

The author has not disclosed any affiliation or financial involvement with organizations or entities with a direct financial interest in the subject matter or material discussed in the manuscript. No funding was received for this work from any organization.

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